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NO.3 - EVOLUTIONARY PSYCHOLOGY

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1. CRITICISING EVOLUTIONARY PSYCHOLOGY AND "POP EVOLUTIONARY PSYCHOLOGY"

1.1. INTRODUCTION

Evolutionary Psychology (EP) [1] can be seen as developing from the work of Donald Symons, John Tooby, and Leda Cosmides at the University of California, Santa Barbara ("Santa Barbara school of EP")(Buller 2009).

EP proposes that "much, if not all, of our behaviour can be explained by appeal to internal psychological mechanisms" that "are adaptations - products of natural selection - that helped our ancestors get around the world, survive and reproduce" (Downes 2008).

Put simply, humans evolved to survive in the Pleistocene era ("environment of evolutionary adaptation"; EEA)(1.8 million to 10 000 years ago) and we are carrying that "equipment" in the modern world. "Human behaviours are not a direct product of natural selection but rather the product of psychological mechanisms that were selected for" (Downes 2008). This "argument-for-design" approach assumes that humans are evolutionary adapted for the EEA not necessarily for today (Byrne 2000).

Tooby and Cosmides (2005) summarised the principles of EP as:

- The brain is a "computer" designed by natural selection;
- Human behaviour comes from this "evolved computer";
- The cognitive programmes within the "computer" allowed the first humans to survive and reproduce effectively;
- These cognitive programmes may, thus, not be adaptive now as the environment has changed from the EEA;
- The brain is made up of many different programmes ("massive modularity hypothesis"; Samuels 1998) that

[1] "EP" in capital letters was used by Buller (2005) to distinguish a particular approach from the general ideas of evolutionary psychology.

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have evolved rather than as a single organ (eg: cheater detection module, the snake fear module).

1.2. CRITICISING "POP EP"

Buller (2009) has coined the phrase "pop EP" to describe aspects of EP that offer "grand and encompassing claims about human nature for popular consumption" (p74).

Buller (2009) listed four fallacies of "pop EP":

1. Analysis of Pleistocene problems tells us about the evolution of the mind [2].

It is argued that we can understand human psychology by knowing how it evolved in the first humans. But there is little direct information from fossils about many aspects of early human life, particularly social, and the fossils may relate to a species of early hominid that have become extinct. Many speculations have to be made: "our ancestors' motivational and cognitive processes would have been selectively response to certain features of the physical and social environments, and this selective responsiveness would have determined which environmental factors affected human evolution. So to identify the adaptive problems that shaped the human mind, we need to know something about ancestral human psychology. But we don't" (Buller 2009 p77).

2. It is possible to discover why certain human traits evolved.

In biology, the comparative method allows researchers to understand the evolution of differences between closely related species with a common ancestor. For example, two species of bird from a common ancestor, one with a long beak and the other with a short beak. "Correlating trait differences with specific environmental variations.. can indicate the environmental demands to which a trait is adapted" (Buller 2009 p77).

This is not possible with human traits because closely related species to humans, like chimpanzees, do not share certain behaviours, like language, or other hominids of the genus Homo (eg: Homo erectus) are not here to compare.

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[2] Panksepp and Panksepp (2000) defined "mind" as a "shorthand way of talking about the more creative ways that brains reach out into the world in their attempts to make sense of internal imbalances and environmental circumstances that can help alleviate those imbalances" (p112).

Language, for example, may have "emerged" not due to specific adaptive pressure, but because of the availability of extra "computational space" in the expanding cortex (Clark 1997). On the other hand, language may have come from "the re-moulding of pre-existing adaptations" (known as "exaptations")(Panksepp and Panksepp 2000).

3. The modern human has a "Stone Age mind".

Though some human psychological mechanisms evolved in the Pleistocene era, some are older than that in evolutionary terms. Panksepp and Panksepp (2000) described emotions as one such example. Emotions such as Care, Panic, and Play have evolutionary origins in early primates, and Fear, Rage, Seeking, and Lust as pre-mammalian.

Take the example of long-term mating (monogamy) and short-term mating (promiscuity) together. EP would say that these two behaviours evolved together as psychological mechanisms in the EEA. But Buller (2009) argued that a tendency towards promiscuity comes from pre-human with the common ancestors of chimpanzees and humans approximately six million years ago. While monogamous tendencies evolved later.

Thus "we possess competing psychological urges. We are pushed toward promiscuity by evolutionary ancient mechanisms of lust and toward long-term pair bonds by more recently evolved emotional systems. Rather than being driven by an integrated Pleistocene psychology that unconsciously calculates which urge to pursue when, we are torn by independently evolved emotional mechanisms" (Buller 2009 p79).

"In reality, some of the most convincing accounts given of the likely evolutionary origins of modern human traits - patterns of infanticide and homicide.., partner choice and matrimonial systems.. - are based on design principles that apply to apes, monkeys, and even non-primates, not specifically to Pleistocene hunter/gatherers" (Byrne 2000 p545).

On the other hand, human evolution has continued since early humans, so we are not stuck in the Stone Age completely. Not to mention the changes in the environment, namely technology and industrial developments, since then. Evolutionary changes in the human genome have been found as recently as 5000 years ago, and it is estimated that humans have evolved faster in the past 10 000 years than since the split from a common ancestor with chimpanzees (Ward 2009).

4. Research evidence today supports EP.

Much of the research evidence for EP comes from artificial experiments and forced choice questionnaires. For example, Buss et al (1992) got men and women to think of their having an affair and asked them which of the two following statements were more distressing: "(A) Imagining your partner forming a deep emotional attachment to that person" or "(B) Imagining your partner enjoying passionate sexual intercourse with that other person". The majority of men chose (B) and women chose (A).

This is used as evidence for the evolution of jealousy differently between the sexes. Men have evolved sexual jealousy because of the concern about paternity, and women emotional jealousy because of the need for male support during pregnancy and child-rearing, it is argued.

Based upon a forced choice option, there is a lot of assumption about what the findings mean. There is contradictory evidence also. For example, Buss et al (1992) found cultural differences in the results. For example, only 28% of men in a German sample and 21% in China were more distressed by (B). If sexual jealousy has evolved, it will be universal.

Buller (2009) argued that both sexes have sexual jealousy, and it is in proportion to the perceived threat of sexual infidelity to a relationship (which can have a cultural basis). There also exists the common belief that men have brief sexual affairs more often and return to the long-term partner.

1.3. CONCLUSIONS

Segal (2001) can see why EP is popular:

> Its simplicity may appeal to the media's inevitable populism (we are what our Stone Age ancestors made us), its alleged biological trappings may consummate some psychologists' dream that their discipline reduces to truths of the natural sciences.. but its scientific credentials have always been the object of rigorous rebuttal from authoritative critics directly engaged with the complexities of human genetics (p422).

While Panksepp and Panksepp (2000) felt that "some correctly fashionable versions of evolutionary psychology are treading rather close to neurologically implausible views of the human mind" (p111).

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2. EVOLUTION OF THE HUMAN BRAIN AND THE MODULAR MIND

2.1. INTRODUCTION

To understand the evolution of a characteristic or behaviour, it is necessary to ask about the historical aspects: "at what approximate data did the characteristic first evolve in the lineage under consideration, in what ancestral species, and before and after which other characteristics" (Byrne 2000 p545). Then there are the causative aspects: "what environmental features so significantly favoured the new characteristic that natural selection perpetuated it in subsequent generations, and out of what original set of genetically encoded characters was it selected" (Byrne 2000 p545).

The human brain is so much larger relative to the body size compared to other mammals. This is because of brain size at birth and postnatal brain growth. Both of these aspects have costs, in terms of risks at birth to mother and child, and the child's need for feeding while helpless for many months. "The numerous costs attendant on human cognitive specialization imply that intelligence has had major evolutionary advantages during the evolution of the species" (Byrne 2000 p544).

When looking for the evolution of a characteristic or behaviour, species are grouped together on the basis of a common ancestor. This produces a clade (Hennig 1966) with a particular shared characteristic, and it can be compared to other clades. For example, humans can be grouped with chimpanzees, bonobos, gorillas, and orang-utans in the "African great apes clade" as opposed to the "Old World monkeys clade" (baboons and macaques) and "New World monkeys clade" (tamarins and capuchins)(Byrne 2000).

Then an attempt is made to establish an evolutionary history of the clade using "evolutionary reconstruction" (Byrne 1995).

The evolution of the human brain, and specifically of primate cognition "began" with a common ancestor between 30-12 million years ago (figure 2.1). The initial

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changes were rapid learning and larger brains, then mental representations, and finally, language much latter (Byrne 2000). The major evolutionary division among primates was between "simians" (which includes monkeys, apes and humans later) and strepsirhines (eg: ring-tailed lemur). This is confirmed by studies of species of lemurs living today who show limited abilities related to intelligence (Byrne 2000).

SPLITS		SPECIES TODAY
(1) PRIMATES 50 MYA		
STREPSIRHINES	→	Ring-tailed lemur
SIMIANS		
(2) SIMIANS 30 MYA		
NEW WORLD MONKEYS	→	Tamarin/Capuchin
(3) SIMIANS 25 MYA		
OLD WORLD MONKEYS	→	Baboons/Macaque
GREAT APES		
(4) GREAT APES 12 MYA		
	→	Orang-utans
(5) GREAT APES 6 MYA		
	→	Gorilla
(6) GREAT APES 4.5 MYA		
	→	Chimpanzees/Bonobos
	→	Humans

MYA = million years ago

(1) Strepsirhines split away from other primates (called simians)
(2) New World monkeys split from other simians
(3) Old World monkeys split from other simians leaving great apes
(4) Orang-utans split from great apes
(5) Gorillas split from great apes
(6) Great apes divide into chimpanzees (and sub-divide later with bonobos) and humans

(After Byrne 2000)

Figure 2.1 - Key evolutionary splits in primates.

Further sub-divisions in the evolution of primates can be seen with differences in intelligence between species today (table 2.1).

GROUP OR CLADE	COGNITIVE ABILITIES
Strepsirhines (lemurs)	No different to other mammals
Simians	Rapid learning abilities compared to
Great apes (gorillas, orang-utans,	Evidence of "theory of mind", self-recognition in mirror, and imitation

Table 2.1 - Three stages in evolution of primates and specific cognitive abilities.

Byrne (2000) noted the key abilities that evolved in great apes initially, and then further in hominids:

- Tool-making and use to aid foraging. This is the use of an object to make the task easier.
- Spatial knowledge and memory when moving around further distances (aided by two legs - bipedal movement).
- "Machiavellian intelligence" (Byrne and Whiten 1988) - living in larger groups produces "social intelligence" including knowing who is an ally, who owes you and who you owe in the group, how to deceive others and how to watch for them deceiving you (trustworthiness and untrustworthiness).
- Social learning and imitation speeds up the process of learning compared to individuals living alone.

The selection pressure on early primates required an ability to learn more rapidly to survive and this produced an enlargement of parts of the cortex. Later group living became a selective pressure on the development of "social intelligence" and further brain enhancements.

2.2. MODULAR MIND

The concept of the modular mind or "massive modularity hypothesis" (Samuels 1998) is an important part of Evolutionary Psychology (EP). Rather than the brain in humans evolving as a whole organ, specific modules or abilities evolved in the first humans to help them survive and reproduce.

Different cognitive skills, like planning and reasoning, are examples of "functionally differentiated modules" or "domain-specific mental modules" (Tooby and Cosmides 1992) in the brain - each module having a specific function. The existence of these modules allows problem-solving, and, in particular, in new situations. The specifics change, but the general principles of the modules remain. For example, the module related to exchange allowed for barter in the past and detailed monetary transactions today (Gigerenzer 1997).

This module may involve certain abilities: including the recall of past exchanges with specific individuals, who cheats, and the knowledge of costs and benefits. The module may include cognitive, emotional, behavioural, and motivational processes (Gigerenzer 1997).

Cosmides and Tooby (1992) see the ability to detect cheaters as crucial. If "cheater-detection" is so important, then this ability will be evident in remembering information. Mealey et al (1996) have found this to be the case. Students were shown male facial photographs for a short period of time along with information about the person (in particular, whether they were trustworthy or not). One week later, recall was better for the faces described as untrustworthy.

As well as individuals recalling untrustworthy faces, snap judgments are made about the characteristics of a person based upon a brief look at their face. Interestingly, different people come to similar conclusions about a particular person based upon their face, irrelevant of the truth of those conclusions: "The owner of an 'honest' face, for example, is no more likely to be trustworthy than anyone else" (Highfield 2009 p30).

But aspects of the face could be evolutionary signals. For example, Carré and McCormick (2008) (appendix 2A) found a link between facial width-to-height ratio and testosterone levels in men. They used the faces of varsity and professional ice hockey players. There was a link between a wider face (cheekbone to cheekbone distance large relative to brow to upper lip distance) and penalties given away for violent acts by these players. A wider face is a sign of higher testosterone.

Wiseman and Jenkins (2009) found that women's faces were easier to identify characteristics from than men's. Through the "New Scientist" magazine website (http://www.facesexperiment.co.uk/), the researchers asked readers to send in facial photographs of themselves and complete a personality questionnaire. The photographs were blended into composites for lucky, humorous, religious, and trustworthy faces. Over 6500 visitors to the website were asked to identify which face went with which characteristic. For women's faces, correct

identification significantly occurred for lucky (70% of people correct), religious (73%), and trustworthy (52%), but not for humorous. There were no significant correct identifications for any of the male faces.

Another key module is relational and abstract thinking (Tooby and Cosmides 1989). The modules that exist today in the brain are those that gave evolutionary advantages to early humans. The idea of modules tends to be a theoretical framework rather than clear physiological regions of the brain.

Geary (1998) lists some of the potential modules: language; facial processing; detection of cheating; theory of mind; kin recognition; in-group recognition; out-group recognition; social ideologies; representation of objects. Appendix 2B gives an example of experimental evidence to support the modular mind (Sell et al 2009).

There are criticisms of these ideas. Cartwright (2000) noted the main areas of debate:

a) The nature of the environment of evolutionary adaptation (EEA) where the "big brain" evolved;

b) Domain specificity of modules and the generalisation of abilities;

c) Correspondence between modules and neurophysiological structures;

d) Little genetic difference between humans and chimpanzees, yet large difference in abilities.

Panksepp and Panksepp (2000) saw little physiological evidence for a modular mind - "the relatively homogeneous columnar organisation of the neocortex is not straightforwardly compatible with any highly resolved, genetically-governed, modular point of view. Indeed, functional studies suggest a vast plasticity in many of the traditionally accepted cortical functions" (p116).

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APPENDIX 2A - CARRĒ AND McCORMICK (2008): FACE AND AGGRESSIVE BEHAVIOUR

Study 1

Aim

To establish the relationship between width-to-height ratio of faces in photographs and the characteristics of dominance and aggression.

Method

Eighty-eight undergraduates (37 male and 51 female) had photographs of their faces taken and their width-to-height ratios were measured (distance between lip and brow = height; distance between right and left cheekbone = width (bizygomatic width)) (http://tinyurl.com/cjk4fm).

The participants filled in a ten-item questionnaire assessing dominance (eg: "Wnat to be in charge").

Their level of aggression was measured by the Point Subtraction Aggression Paradigm (PSAP)(Cherek 1981). Participants were led to believe that they were competing in a game for points against a same-sex competitor via a computer, when, in fact, the E-Prime computer programme was making random responses. The participants had three strategies, which was what was being measured: to earn products for themselves, to take points from the opponent ("aggression") or protect their points from theft by the opponent (box 2A.1).

The PSAP took forty minutes, and afterwards were debriefed concerning the deception and to see if they realised there was not a real opponent.

Findings

Men with a greater facial ratio were significantly more aggressive in the PSAP, and scored higher on the dominance questionnaire than women.

Study 2

Aim

To establish the relationship between width-to-height ratio of the face and aggressive behaviour in male varsity level hockey players.

PSAP Methodology

The "participants were led to believe that they would be paired with a same-sex partner (in actuality, an E-PRIME computer program) on a task that required them to select among three response options to earn points that would be exchangeable for money. Pressing response option no.1 a hundred consecutive times would cause the point counter on the screen to enlarge, flash several times with positive signs around it, and increase the point counter total by one. It was explained to participants that the point counter might flash several times with negative signs around it, resulting in a one-point decrease in the point counter total. They were told that this meant that their partner (actually the computer program) had stolen a point, and each stolen point would be added to the partner's counter.

Participants could respond by continuing to select option no. 1 (point reward) or could switch to option no.2 or 3. Pressing option no.2 ten times would steal a point from their partner; however, participants were instructed that they were randomly assigned to the experimental condition whereby they, unlike their partner, would not keep any points stolen. Pressing option no.3 ten times would protect their point counter against theft of points for a brief time. Thus, the dependent variables from the PSAP measure were option nos.1 (reward earned), 2 (aggression) and 3 (protection). Selection of option no. 2 was considered reactive aggression because the participants did not increase reward, and in fact lost opportunity to increase reward, each time option no. 2 was selected" (Carré and

Box 2A.1 - PSAP methodology in detail.

Method

Photographs were obtained from the Ontario University Athletics website (http://www.oua.ca/) for 21 undergraduate male ice hockey players. All the pictures were facing forward. Aggressive behaviour was measured by the number of penalty minutes obtained per game in the 2007-08 season. Te penalties included behaviours like elbowing an opponent, fighting, and slashing (with hockey stick), and the data were also obtained from the university website. In ice hockey, players are sent to the "sin bin" for certain lengths of time after violent play.

Findings

There was a significant positive correlation between face ratio and penalty minutes per game played.

Study 3

Aim

To establish the relationship between facial width-

to-height ratio and aggressive behaviour among professional ice hockey players in the Canadian teams in the North American National Hockey League (NHL).

Method

112 photographs of players from six teams in the 2007-08 season were obtained from a sports television website (http://espn.go.com/nhl/). Aggressive behaviour was measured as in study 2.

Findings

There was a significant positive correlation between face width-to-height ratio and aggressive behaviour in the game. The data were analysed for each team, and positive correlations were found ranging from 0.17 (Calgary Flames) to 0.51 (Ottawa Senators).

General Conclusions

"The data obtained here suggest that for men variation in the width-to-height ratio from neutral faces may be a honest signal of propensity of aggressive behaviour" (Carré and McCormick 2008 p2654). Table 2A.1 summarises the statistical significance results.

STUDY	CORRELATION (r) AND	MANOVA (multivariate
1	0.38 (p = 0.02)	15% in variance in
2	0.54 (p = 0.01)	29.2%
3	0.30 (p = 0.005)	"significant proportion"

Table 2A.1 - Summary of statistical test results.

Study 1 established that the relationship did not exist for women, while studies 2 and 3 used real-life data. Table 2A.2 gives the strengths and weaknesses of the studies.

STUDY 1

Strengths

1. Face measurements made separately by two researchers and then checked (agreement of 98.5% or greater).

2. Standard questionnaire measure of dominance used (International Personality Item Pool scales; Goldberg et al 2006).

3. PSAP is a standard measure of aggressive behaviour used in experiments, and positively correlated with self-reported measures of aggression.

4. The majority (82%) of participants were self-identified as Caucasian.

Weaknesses

1. The undergraduates took part in the study for course credit and a small fee. They were not completely volunteers.

2. The participants were deceived during the PSAP.

3. The PSAP is an artificial task and may not accurately represent the individual's aggressive behaviour in real-life. Technically, it is a situation-specific measure of "reactive aggression".

4. More of the participants were female than male.

STUDIES 2 AND 3

Strengths

1. Use of real-life data on aggressive behaviour (that was easily available).

2. Because using secondary data, there is no risk of participant reactivity as in study 1.

3. Aggressive behaviour clearly defined as penalties according to rules of ice hockey. Though actual referees in each game may have different interpretations.

4. Able to use data in a way that would be difficult if working directly with participants. It would be time-consuming and expensive to count the penalties themselves, and photograph the faces of the players.

Weaknesses

1. The researchers did not collect the data themselves, and so are dependent on the accuracy of the websites.

2. Not all facial photographs were the same (eg: some were smiling) whereas in study 1 the photographs were standardised. For example, an aggressive men may tilt their head upwards and foreshorten the vertical measurement of the face.

3. Aggressive behaviour in ice hockey matches is a specific event and may not generalise to aggression outside the games.
4. Permission was not gained for the use of the photographs. It was assumed that being on a website is public domain and acceptable to use.

OVERALL EVALUATION

1. The first study to establish the relationship between width-to-height ratio of the face and aggressive behaviour in males.

2. It combined both laboratory and real-life data.

3. The results were only correlational not causation.

4. The Pearson's product moment correlation coefficient was the parametric statistical test used.

Advantages

- More powerful than non-parametric alternatives like Spearman's rank correlation coefficient.
- More sensitive to features of the data collected (Coolican 1990).
- Less chance of type I or type II errors (Coolican 1990).
- Robust (Coolican 1990).
- Takes into account the actual values of the scores when calculating the amount of the correlation (Greene and D'Oliveira 1982).

Disadvantages

- Requires fulfilment of certain criteria of type, distribution, and variance of data for use.
- It was assumed that the data was drawn from a normally distributed population, but this may not be the case as ice hockey players are not typical of the general population, nor that the season 2007-08 was typical for penalties.
- Outliers distort the value of r.
- It assumes a linear relationship between the two variables studied.
- Variables measured on different scales does matter; eg: penalty minutes (ratio data) and width-to-height face ratio (ordinal data?).

Table 2A.2 - Strengths and weaknesses of the studies by Carré and McCormick (2008).

APPENDIX 2B: AN EXAMPLE OF EXPERIMENTAL EVIDENCE TO SUPPORT THE MODULAR MIND (Sell et al 2009)

One example of a module would be a mechanism by which to assess the formidability of opponents. The accurate ability to tell if a rival can be defeated or will be the victor reduces the amount of actual conflict.

In humans, the ability to assess upper-body strength is relevant because men have 75% more muscle mass in their arms than women on average, but only 50% more in the legs (Sell et al 2009). So "the cognitive specialisations for strength assessment are expected to be better engineered for evaluating males than females" (Sell et al 2009 p576).

From this observation, Sell et al made a number of predictions to test:

(a) Humans should be good at assessing others' actual physical strength from visual cues in the body;

(b) The process should be more accurate for assessing male bodies (as more aggression is male-male);

(c) The assessment of ability to win fights should be linked to physical strength not weight and height, for example;

(d) Humans should be able to assess physical strength from the face when no other information is available;

(e) Face-derived strength assessments should correlate to upper-body strength;

(f) If this whole process is universal, individuals should be able to assess the strength of individuals from other cultures.

Study 1

This study aimed to find out if men's strength could be assessed from photographs of the face, body, and full person. The photographs used were 59 male undergraduates who used the weight-lifting machines in the campus gym regularly at the University of California, Santa Barbara (UCSB). Each participant posed for a facial photograph, and a full body, no shirt, one (with the face obscured) standing next to a fully-clothed experimenter for scale (http://tinyurl.com/bk6zu7). Upper-body strength was measured for each participant using weight-lifting

machines.

Then 142 UCSB undergraduates were asked, "Please rate the following on how physically strong you think the man is compared to other men of his age" using a seven-point scale (1 = very weak, 7 = very strong). Thirty-seven additional participants were asked to rate "how tough each would be in a physical fight" on a seven-point scale.

The correlation between perceived strength and actual upper-body lifting strength was significant for the body, full person, and facial photographs. "This robust correlation shows that men's faces contain cues from which strength can be accurately assessed, and that human minds are tuned to pick up on the cues" (Sell et al 2009 pp577-8).

The perception of fighting ability correlated very highly (r = 0.96) with perceptions of physical strength despite the fact that the two abilities were rated by separate groups.

Study 2

This study expanded on the previous one to include men from the general population and women to assess for physical strength. At UCSB, 109 male and 146 female students agreed to be photographed for face-alone or body-alone (ie: face obscured) versions. Chest/arm strength was measured by a Rolyan Hydraulic hand dynamometer (measures grip strength).

Then 76 female and fifty-six male undergraduates were asked to rate the photographs for strength as in study 1. It was found that perceived strength of the men and women strongly correlated with actual physical strength in both body and face photographs. The perception of women's strength from their faces was weakest. Male raters were more accurate at assessing female strength.

Study 3

This study introduced a cross-cultural element asking 32 UCSB undergraduates to rate from facial photographs the strength of 53 adult Tsimane men ("forager-horticulturalists") from lowland Bolivia. The correlation between perceived and actual strength was high again, and, in some cases, higher than for US photographs (own culture of raters).

Study 4

This replicated study 3 using face-only photographs

of 28 men from rural Argentina as rated by 28 UCSB undergraduates. Similar results as above were found.

Further Data Analysis

Further analysis of the results showed that the perceived strength rating was associated with upper-body strength and not leg-strength nor other body size variables like height and weight.

Conclusions

Sell et al (2009) argued that the findings support an evolutionary mechanism to accurately assess the formidability of rivals. This ability occurs when the body is visible, but also when only the face can be seen, and the cues used are independent of body size.

How is the strength of an individual visible in the face only? The answer seems to be that levels of testosterone influence physical development including the face. So individuals with high levels of testosterone (and thus probably physical strength) will have different faces in some physical way to low level testosterone individuals. More testosterone produces the thickening of the brow ridge, squaring of the jaw, and increasing the face's width relative to length.

Tables 2B.1 and 2B.2 summarise the findings for the four studies in relation to the predictions.

STUDY	PHOTOGRAPHS AND PARTICIPANTS	SIGNIFICANT CORRELATIONS BETWEEN PERCEIVED AND
1	142 and 37 US students assessed 59 male US students'	Full person: r = 0.71 Body alone: r = 0.66
2	132 US students assessed photographs of 109 male and 146 female US students	Male body alone: r = 0.57 Male face alone: r = 0.39 Male body: r = 0.51 Female body: r = 0.51
3	32 US students assessed 53 adult Tsimane men from	Face only: r = 0.52
4	28 US students assessed 28 adult rural men from	Face only: r = 0.47

Table 2B.1 - Summary of four studies by Sell et al (2009).

PREDICTIONS	EVIDENCE
(a) Humans should be good at assessing others' actual physical strength from visual cues in the body.	(a) All studies
(b) The process should be more accurate for assessing male bodies (as more aggression is male-male).	(b) Study 2
(c) The assessment of ability to win fights should be linked to physical strength not weight and height, for example.	(c) Further Data Analysis
(d) Humans should be able to assess physical strength from the face when no other information is available.	(d) All studies
(e) Face-derived strength assessments should correlate to upper-body strength.	(e) All studies
(f) If this whole process is universal, individuals should be able to assess the strength of individuals from other	(f) Studies 3 and 4

Table 2B.2 - Predictions by Sell et al (2009) and findings.

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3. STUDYING HUMAN FEMALE SIGNALS OF FERTILITY

3.1. INTRODUCTION

Humans have traditionally been seen as different to other primates where the females advertise their fertility through "sexual swellings". For humans, it is concealed ovulation [3] with no obvious signs of fertility. However, there are "signals" [4] given by the female at the peak time of her fertility.

Alexander and Noonan (1979) saw concealed ovulation leading to the "daddy at home hypothesis": the male stays at home and pays attention to the female to assure his paternity. The conflict between the sexes as part of co-evolution: males want to spread their genes but females evolve strategies against this and for their benefit.

Also concealed ovulation could prevent infanticide by males, and is an example of a "dishonest signal" given by females of their reproductive status (Hrdy 1979). This is sometimes called the "nice daddy theory".

Furthermore, concealed ovulation allows the female to seek out "clandestine copulations" - the "cuckoldry hypothesis" (Schroder 1993).

Other explanations for concealed ovulation include

[3] Havlicek et al (2006) preferred to talk of a "non-advertised ovulation".

[4] These are "subtle behavioural signals that fly below the radar of conscious intention or perception" (Miller et al 2007 p380).

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the link to the evolution of monogamy when compared to other primates (Sillen-Tillberg and Mollen 1993); the reduction of male-male aggression (Etkin 1984); and preventing women from avoiding pregnancy (Burley 1979).

3.2. SIGNALS OF FEMALE FERTILITY

Research has looked at how female attractiveness to males increases just before ovulation (the most fertile time - oestrus). A number of "signals" have been noted.

3.2.1 Body odour

The smell of women change over the menstrual cycle. Havlicek et al (2006) used participants from Charles University in Prague, Czech Republic. Twelve female students, not using the contraceptive pill, donated their body odour on a cotton pad worn in the armpit for 24 hours, once a week, for five weeks. The women were instructed to refrain from wearing deodorants and perfumes, smoking, drinking alcohol, and eating aromatic foods, like garlic, while wearing the pads.

Forty-two male students rated the odours on the cotton pads for intensity, pleasantness, sexual attractiveness, and femininity on a seven-point scale. Attractiveness and pleasantness were rated as significantly higher for odours collected during days 7-14 of the menstrual cycle (when fertility highest), while intensity was strongest during menstruation. The ratings of femininity correlated with attractiveness.

3.2.2. Evaluation of Methodology: Havlicek et al (2006)

1. Only a small sample (n = 12) of women completed five weeks of study, and seven others dropped out.

2. The menstrual cycle of the women was based upon self-reports, and not verified by physiological measures. Only five women gave the date of onset of menstrual bleeding, so a calculation of the menstrual cycle was made. The authors argued that it was "unlikely that the random error introduced by our method of menstrual cycle estimation spuriously generated any significant relationship, the results we obtained would probably underestimate rather than overestimate actual effects.." (p83).

3. This study used cotton pads rather than the worn T-

shirt as in other studies, like Singh and Bronstad (2001), because of the fear that other compounds may contaminate the T-shirt and thus the odour.

4. The women had to discipline themselves in terms of food eaten and deodorants worn on the day before and on the day wearing the pads (table 3.1). There is no guarantee that the women maintained every aspect of the protocol.

They were instructed to refrain from: (1) using perfumes, deodorants, antiperspirants, aftershave and shower gels, (2) eating meals containing garlic, onion, chilli, pepper, vinegar, blue cheese, cabbage, radish, fermented milk products, marinated fish, (3) drinking alcoholic beverages or using other drugs, (4) smoking, (5) sexual activity and sleeping in the bed of the partner the day before and on the day of wearing the

Table 3.1 - Instructions from Havlicek et al (2006).

5. The male participants rated the odours each week at the same time, the morning after the pads worn. Intensity of odour declines with length of storage. The participants sniffed the pads, which were kept in glass jars, for as long as they wanted. The code on the jar changed each time, so the men could not remember which pad was linked to which odour last time.

The experiment was a repeated measures design which removes the risk of individual differences between the participants, but has the problem of order effects (eg: not putting as much effort into the later sessions as to the early ones due to boredom)(table 3.2).

6. The purpose of the experiment is hard to hide from the male raters. If the participants know the purpose of the research, there is an increased risk of demand characteristics.

7. The order of the presentation of the pads was randomised for each session.

8. The rating scale for the odours was a seven-point Likert scale from, for example, "very unpleasant" to "very pleasant" (table 3.3). It is an ordinal scale. This means that the distance between each unit on the scale is not standardised like time, and to overcome this problem

ADVANTAGES	DISADVANTAGES
1. Eliminates individual differences because all participants perform all conditions. 2. Need less total number of participants compared to independent design experiments. 3. Only design when comparing scores to an individual baseline.	1. Order effects (including practice or fatigue). Need to counterbalance and randomise stimuli in experiment. 2. Aim of research may become obvious to participants. 3. Participants have to be available for all conditions of the experiment or else their data are removed as a drop-out.

Table 3.2 - Advantages and disadvantages of the repeated measures experimental design.

the researchers converted each participant's raw rating into a z-score.

This is a standardised measure calculated as z = (x - M)/SD, where "x" is the raw rating, "M" is the mean rating of the participant for that variable (eg: pleasantness), and "SD" is the standard deviation . The z-score tells us the number of standard deviations a particular score is from the mean based on the normal distribution of data (Coolican 1990).

ADVANTAGES	DISADVANTAGES
1. Straightforward to use. 2. Easy to construct. 3. Provides clear numerical scores.	1. Dependent on honesty of respondents. 2. Respondents can tell purpose of scale, and thus risk of "social desirability bias".

Table 3.3 - Advantages and disadvantages of the Likert scale.

9. The "follicular phase" (most fertile) of the menstrual cycle was defined as days 7-14, whereas Singh and Bronstad (2001) used days 13-15. The broader definition allows for the problem of accurate calculation of the menstrual cycle.

10. The findings of this study confirmed those of Kuukasjarvi et al (2004), Poran (1994), Singh and Bronstad (2001), and Thornhill et al (2003), but are contrary to Thornhill and Gangestad (1999) who found no significant differences in ratings of attractiveness of the women's body odour in the follicular and luteal (pre-menstruation) phases.

11. The study did not include a control group of wome using the contraceptive pill. Kuukasjarvi et al (2004) found no significant difference in odour ratings throughout the menstrual cycle. They also included female raters of the odours who did not rate any differences for contraceptive and non-contraceptive pill using women or for the time of the month.

12. The research used odour from the armpit, but vaginal odour is also reported to change during the menstrual cycle (Havlicek et al 2006).

13. It is a laboratory-based study, which means low ecological validity, and smelling cotton pads in a jar is untypical of real-life situations.

3.2.3. Facial attractiveness

Female facial attractiveness varies over the menstrual cycle. Roberts et al (2004) took two facial photographs, without cosmetics and with a neutral expression, of 48 non-contraceptive pill using women from the UK (Newcastle) and the Czech Republic (Prague). One photographed was taken between days 8-14 of the menstrual cycle (peak fertility) and the other between days 17-25 (luteal phase). The order of the photographs were counterbalanced.

Both photographs of the same woman were presented to 130 men and 131 women from the same countries, who had to choose their preferred one. Half of the images were masked (obscuring ears and hair) and half not.

The raters, both men and women, significantly preferred the image from the follicular phase (table 3.4). The women had a stronger preference for unmasked photographs during this phase.

The facial differences during the menstrual cycle probably include lip colour and size, and pupillary dilation.

Table 3.5 summarises the key advantages and disadvantages of this study.

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	MASKED		UNMASKED	
	MALE	FEMALE	MALE	FEMALE
Prague	55	55	55	58
Newcastle	ns	53	ns	55

(ns = not significant)

Table 3.4 - Percentage of participants choosing follicular phase photograph.

ADVANTAGES

1. Comparison of participants from universities in two different countries.

2. Use of both male and female raters.

3. Standardised facial photographs of women.

DISADVANTAGES

1. No physiological verification of menstrual cycle.

2. Participants forced to choose between the two photographs, and no middle group.

3. No control group of photographs of women using the contraceptive pill.

Table 3.5 - Key advantages and disadvantages of Roberts et al (2004).

3.2.4. Soft tissue body part symmetry

Fluctuating asymmetry is "small random deviations from perfect bilateral symmetry that are thought to accumulate during development" and "is therefore a measure of one component of fitness, that is, developmental stability" (Manning et al 1996 p129). This is the difference in body part symmetry between individuals, but an individual can have changes in symmetry over time, like cyclical asymmetry.

Cyclical asymmetry is changes in soft tissue like ears, digits and breasts relative to the menstrual cycle.

Manning et al (1996) measured ear length, wrist width, and length of 2nd, 3rd and 5th digits of non-contraceptive pill using women at different times in the menstrual cycle. Symmetry between the left and right body parts were calculated as left side minus right side. Ovulation was determined by self reports about the menstrual bleeding, and ultrasonography scans.

Symmetry of body parts was closest around ovulation

with the mean difference between right and left body parts was 1.23mm for days 10-19 of the menstrual cycle compared to 20.2mm for days 1-9.

In a second study, Manning et al used data from mammograms of 280 women at the University of Liverpool Breast Screening Unit between 1980-5 to measure changes in breast symmetry over the menstrual cycle. Symmetry was recorded as the size of the left breast minus the size of the right, and, as in the first study, scores near zero would mean both breasts were the same size. The breasts were most symmetrical at ovulation.

In both studies body parts were most asymmetrical during menstruation. Thus symmetry of certain soft tissue body parts correlates with fertility and asymmetry with infertility.

3.2.5. Evaluation of study: Manning et al (1996)

1. In the first study, different participants were in investigated in different ways: fifteen participants measured at seven-day intervals, seven participants measured 7-13 times in one menstrual cycle, three women were measured 22-44 times over 44-47 days, and three measured daily for five days around ovulation.

2. Physiological and self-reported measures of the menstrual cycle.

3. Complex statistical techniques, that transformed absolute and relative asymmetries (eg: second-order polynomial regression), were used to standardise the body parts measurements, particularly of the breasts, including inter-rater reliability by two separate raters.

4. Some of the women in study 2 reported using the contraceptive pill (34 of 280). Their data were removed from the analysis.

5. Though symmetry of body parts could be a sign of ovulation, dieting and exercise can create symmetry throughout the menstrual cycle.

3.2.6. Other Physiological Changes

a. Reduced waist-to-hip ratio (WHR)

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Kirchengast and Gartner (2002) reported reduced WHR in women around ovulation.

Singh (1993) introduced the idea of the waist-to-hip ratio (WHR) of 0.7 being the most desirable as seen in "Playboy" centrefolds and "Miss America" winners. It is not the actual weight, but the distribution of the weight that is key.

A WHR of 0.7 is associated with health and fertility. This preferences was shown over sixty years even when the actual weight of models varied. Though this study was in the USA with white males, Singh (1995) found similar results with Chinese-Indonesian men arriving in the USA.

b. Skin colour lighter (Van den Berghe and Frost 1986)

3.2.7. Cognitive abilities

Symonds et al (2004) recruited sixteen healthy non-contraceptive pill using female volunteers from the Newcastle-upon-Tyne area of northern England. They were asked to keep a menstrual cycle diary, and samples of urine (for cortisol measurements) and saliva (for dehydroepiandrosterone; DHEA) were taken before cognitive testing.

Nine different cognitive tests were used including verbal fluency (eg: sixty seconds to generate as many words as possible starting with a particular letter), immediate recall and delayed recall (30 minutes) of fifteen words, and visual recognition memory for patterns. The participants were tested twice in the menstrual cycle - close to ovulation (mid-follicular phase) and just before menstruation (late-luteal phase).

Significant differences were found in cognitive performance between the two occasions including verbal fluency greater around ovulation (mean of 44.2 vs 40.5 words generated), and slower response times to letter sequences at ovulation (mean of 355.3ms vs 329.3ms). There were no significant differences in memory.

3.2.8. Evaluation of study: Symonds et al (2004)

1. This study was primarily interested in cognitive changes during pre-menstruation rather than at ovulation.

2. A small number of women were studied: sixteen with one of them dropping out.

3. This was a repeated measures experiment with counterbalancing: half the women tested in the follicular phase first, and the others in the luteal phase first.

4. Both physiological and self-reported measures of the menstrual cycle. The urine and saliva tests were based on standardised techniques used. However, measures of luteinising hormone may be more accurate for assessing the stage in the menstrual cycle.

5. Cognitive testing took place between 12.00 and 16.00 hours each time to avoid the confounding variable of different times of the day.

6. The cognitive tests used were standardised and many were computerised tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB)(table 3.6).

ADVANTAGES	DISADVANTAGES
1. Reduce human interaction and thus potential confounding variable. 2. Accurate measures of response time which are better than human timekeeping. 3. Standardised procedure by computer that does not vary in anyway. 4. Standardised tests with establish norms and controls.	1. Tests can be repetitive and uninteresting, and feel sterile done on a computer. 2. Some participants may prefer human contact, particularly to clarify details of procedure if unclear. 3. Participants may misread the instructions on the computer screen. 4. Participants may find using computers difficult or

Table 3.6 - Advantages and disadvantages of using computerised tests.

7. Some of the cognitive tests were boring and/or tiring; eg: Vigil Continuous Performance Test (Cegalis and Bowlin 1991) requires the participants to respond to a particular letter sequence as stimuli are presented for over eight minutes.

8. The cognitive tests typically study cognitive abilities in an artificial way; eg: recall of "15 semantically and phonetically unrelated common, concrete

nouns". Memory in everyday life is not like this.

9. A previous study had contrary results. Maki et al (2002) found that verbal fluency increased in the luteal phase of the menstrual cycle.

10. What are the evolutionary benefits for the differences in cognitive ability found at the time of ovulation?

3.2.9. Changes in Behaviour

- Increased flirtatiousness (Matteo and Rissman 1984)
- Reduced appetite (Fessler 2003)
- Increased volunteering for social activities (Fessler 2003)
- Increased desire to go to clubs/parties where men may be (Haselton and Gangestad 2006)
- Increased attentiveness to "maleness" as shown by faster categorising of male faces and male stereotypic words (Macrae et al 2002)

The preference of females has been found to change over the menstrual cycle. Penton-Voak et al (1999) showed that Japanese female students preferred less feminine male faces in the high-conception-risk phase of their cycles. But, in the same research, British female students had different preferences depending upon whether the scenario was for a short or long term relationship.

For the latter situation, the preference was constant throughout the fertility cycle: more feminine than for short-term relationships. The researchers explained the results:

> A female might choose a primary partner whose low masculine appearance suggests co-operation in parental care... but occasionally copulate with a male with a more masculine appearance (indicating good immunocompetence) when conception is most likely. Sexual behaviour arising from cyclic preferences might allow individuals to accrue benefits from polyandry while maintaining the advantage of ostensive monandry (pp741-2).

- Reduced attractiveness ratings of photographs of female faces (Fisher 2004).

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3.2.10. Clothes Worn

The "ornamental effect" predicts that women will pay more attention to attractive clothes and personal grooming when near peak fertility.

Haselton et al (2007) photographed thirty young women at UCLA, California, not on the contraceptive pill and in committed relationships with a man, wearing self-chosen clothes at two points in their monthly cycle (peak and low fertility). The photographs were standing full-body shots. The women were blind to the study's purpose being told it was about health, personality, and sexuality.

Then 42 participants (17 male and twenty-five female) also from UCLA were asked, "In which photographed is the person trying to look more attractive?" while viewing the photographs via the Internet. 60% of the time the photograph was chosen from when the women were at their peak fertility.

Three female research assistants, blind to the study purpose, were asked to rate the photographs on eight other criteria, like "showing more skin (upper body)", "showing more skin (lower body)", and "wearing 'nicer clothes'". The photographs at high fertility were rated more on these criteria.

The authors proposed possible explanations for the link between ovulation and clothing choice:

i) Women more aware of their attractiveness near ovulation and this influences their clothing choice;

ii) Women more interested in extra-pair mating at high fertility and thus dress to attract men;

iii) Style of clothing may also vary with mood which varies over the menstrual cycle;

iv) Women become more sociable near ovulation and this influences clothes worn.

An Evolutionary Psychology explanation of women's behaviour would favour the second possibility above, and also that other explanations are manifestations of the desire for extra-pair mating at times of peak fertility.

Table 3.7 gives the advantages and disadvantages of this study.

ADVANTAGES

1. Physiological measures of menstrual cycle: urine tests to measure luteinising hormone surge 24-48 hours prior to ovulation.

2. Standardised photographs taken at the same location with identical lighting and background.

3. All women self-rated as in a "committed romantic relationship" with a man.

4. Those photographed and raters were blind to purpose of the study.

5. Both male and female raters used.

6. The raters were volunteers recruited by word of mouth.

7. The raters were sent a unique Internet address link for rating the photographs using a computer-based survey programme. This removed human influences from the process (eg: experimenter-participant interaction variables).

8. This study has all the rigour of the experimental method.

DISADVANTAGES

1. High drop-out rate (n = 28) by women being photographed, nearly 50% of original sample. The reasons included no luteinising hormone surge, no consent for photographs to be used, or unavailable at time required.

2. Being in a "committed romantic relationship" is not a standardised concept because the length of the relationship will vary as will the degree of commitment, and the state of the relationship (eg: regular arguments).

3. The judges rated the photographs via the Internet, so the researchers had no control over thsi aspect of the experiment (eg: other people present and influence rating).

4. Half of the photographed women rated themselves as "Asian American, six as "Caucasian", one "African American", seven "Hispanic/Latino", and six "mixed race"/"other". The ethnicity of the raters is not mentioned, but inter-racial rating may have influenced the results.

5. No control groups of contraceptive pill using women ans/or women not in committed relationship.

6. There were more female judges (n = 25) than male (n = 17).

7. Judges were volunteers, who are not necessarily typical of the general population, who were recruited by word of mouth. This can mean sampling bias.

8. The choice of clothes by the women in the photographs could have been influenced by external constraints, like where been or where going after photographing. This could be a confounding variable.

Table 3.7 - Advantages and disadvantages of Haselton et al (2007).

3.2.11. VOICE

The voice changes over the menstrual cycle. The female voice can become more hoarse around the time of menstruation due to hormonal changes in the body (eg: Whitehead et al 2004).

While Pipitone and Gallup (2008) found that the voices of seventeen non-contraceptive pill using women were judged as more attractive close to ovulation compared to other times of the month. This study, however, did not confirm ovulation with physiological measures nor perform acoustical analysis to find what was different about the voice (Bryant and Haselton 2009).

Bryant and Haselton (2009) set out to rectify these weaknesses in their study. The voice was analysed using computer software for fundamental frequency, which is perceived pitch differences between men and women. Femininity is perceived as a higher pitch.

Sixty-nine young women (average age 20.30 years) from the University of California at Los Angeles (UCLA) not using the contraceptive pill were the participants. The periods of low-fertility and high-fertility in the women's menstrual cycles were established from luteinising hormone in their urine.

Vocal recordings were made at high and low fertility and involved saying: (i) "Hi, I'm a student at UCLA", (ii) five vowels (eg: "eh" as in "bet"), and (iii) a prolonged (five seconds) "ah". The order of recordings was varied between participants as was the two sessions (high and low fertility first).

For the sentence, it was found that the pitch of the women's voices was significantly higher for the high-fertility recordings (ie: two days preceding ovulation). There were no significant differences for the vowel sounds. This shows a pitch shift as a cue of peak fertility.

The findings fit with other studies which have shown that men prefer higher pitched women's voices (eg: Feinberg et al 2005).

Table 3.8 summarises the key strengths and weaknesses of the Bryant and Haselton study.

3.3. MALE RESPONSE TO FEMALE "SIGNALS"

The question is whether men are sensitive to these "signals". Miller et al (2007) tested this by measuring the tips earned by professional lap dancers in gentlemen's clubs in Albuquerque, New Mexico, over a two-month period between November 2006 and January 2007.

Lap dancers were recruited from local clubs to the

university, and their identity was kept secret by giving

STRENGTHS	WEAKNESSES
1. Physiological measure used to establish exact timings of menstrual cycle. 2. Vocal recordings used standard equipment in a quiet room. The women were asked to repeat the sounds until the utterances were acceptable for analysis. 3. Counterbalancing order of sounds and order of sessions. 4. To check that the pitch differences could be perceived, fifteen participants were asked to choose a higher pitched voice from a pair. They were correct	1. The vocal recordings were short. 2. Only 69 women were eligible from an original sample of 114. The others were removed because they showed no LH surge (n=15), recordings at the wrong time of cycle (n=8), failed to complete both sessions (n=20), or problems with recordings (n=2). 3. Order effects. 4. The sample were mostly students.

Table 3.8 - Key strengths and weaknesses of the Bryant and Haselton (2009) study.

them an anonymous ID number. Each day during the study, the women logged onto the research website and reported their mood, work hours, tip earnings, and state of menstruation. Eighteen women were involved in the study, of which eleven were not using the contraceptive pill.

Days 9-15 of the menstrual cycle were classed as the peak time of fertility, compared to days 1-5 (menstruation) and days 18-28 (luteal phase). Average tip earnings per shift were higher during the peak fertility period compared to the rest of the menstrual cycle (table 3.9).

	NON-CONTRACEPTIVE	CONTRACEPTIVE PILL
DAYS 1-5	180	140
18-28	260	180
9-15*	350	200

(* peak fertility)

Table 3.9 - Average tip earnings ($ US) per shift based on three phases of menstrual cycle.

"When women and men interact intimately over the course of several minutes through conversation and body contact, women apparently either 'signal' or 'leak' cues

of their fertility status, and these cues influence spending patterns by male consumers. These results argue against the view that human oestrus evolved to be lost or hidden from males.." (Miller et al 2007 p379). The change in tip earnings was not due to difference in clothing worn by women, as little is worn, but by physical "signals".

Table 3.10 lists the advantages and disadvantages of this study.

ADVANTAGES

1. Use of real-life scenario gives the study high ecological validity.

2. More realistic measures of attractiveness (ie: visual, verbal, olfactory, and tactile) than photographs used in laboratory experiments.

3. To avoid demand characteristics, details about the link between tip earnings and the menstrual cycle was hidden within a large amount of information required (eg: work experience, sexual experience and attitudes), and the women were never explicitly told about the purpose of the study until afterwards.

4. The women's identity was kept hidden, even from the researchers, and anonymity maintained by use of a website to collect data. Initially the women collected an experiment package from a public location on the university campus.

5. The researchers divided the menstrual cycle carefully in three phases: menstrual (days 1-5), days 6-8 not included, fertile (days 9-15), days 16 and 17 not included, and luteal (days 18-28). The not included days helped divided the three phases of the cycle clearly and avoid any risks of overlap between them.

6. Inclusion of lap dancers using the contraceptive pill and not gave a comparison group.

7. Though the sample was small, the participants worked 296 shifts and over 5300 lap dances.

8. Tip earnings are an objective measure of women's attractiveness, while laboratory studies tend to use attitude scales (subjective).

9. The demographics of the sample (eg: mean age - 26.9 years; mean time lap dancing - 6.4 years) appeared similar to previous studies.

DISADVANTAGES

1. The researchers depended on the women's responses including honesty about tips, and accurate recall of information.

2. No independent physiological measure of the menstrual cycle (eg: luteinising hormone).

3. Small sample - eleven non-contraceptive pill using dancers, and from one city in the USA limits the generalisability of results.

4. The anonymity could encourage the participants to give false information knowing it can never be verified.

5. Fertility estimates are imperfect, and the most fertile period can vary within the menstrual cycle.

6. The participants were volunteers, and such individuals may not be typical of the research population or the general population.

7. Assumption that tip earnings are linked to the menstrual cycle. There was no information on how many men in the clubs and their tipping behaviour. There was no information on how the women danced (ie: some better than others) or how many/which women worked together that could influence the results.

8. This study was not an experiment, so it did not have the control over variables which allows the establishing of cause and effect.

9. The recruitment of participants was difficult: "indirect emails (forwarded through local industry contacts), newspaper advertisements, and flyers posted near clubs" (p377).

Table 3.10 - Advantages and disadvantages of research by Miller et al (2007).

3.4. GENERAL EVALUATION OF RESEARCH

1.An Evolutionary Psychology approach can be deterministic and reductionist. All behaviour is determined by biology and reduced to that level of understanding.

2. The dominant position of scientific interpretations of behaviour.

3. Evolutionary explanations play down the role of culture and society.

4. Scientific approaches are essentialist. This means that it focuses upon inner states and essences, while social constructionists would argue that all behaviour is socially constructed by discourses.

5. Research ignores the individual's experience of their body, which is ascertained through qualitative methods.

6. The ignoring of alternative experiences, like non-heterosexual women.

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4. MATING SKEW IN HUMANS

4.1. INTRODUCTION

Mating opportunities and success are not equal for all individual animals (Darwin 1874). Some individuals will have more matings, like the dominant male in a polygamous group. This produces a mating skew: "A few males meet with a great deal of success, whereas others have little or even no success" (Lenton et al 2009 p55).

Female mate choice will support this situation because the dominant male usually has the characteristics signalling "good genes". Animal observations show that males with the higher copulation rates have more of the desirable characteristics of that species, like body size or ornaments (eg: male peacock's tail).

This situation of mating skew is challenged in a number of ways (Lenton et al 2009):

- Coalitions of lower-ranking males who work against the dominant male. For example, one of the coalition distracts the dominant male while the other mates with the unguarded female, and later they swap over. Thus the distribution of who mates is more even. But a larger group may mean more competition between low-ranking males, and the dominant males continues to mate with many females (eg: mandrills; Charpentier et al 2005).

- Practical factors limit the dominant male's ability to monopolise all females, like exhaustion, and females being unguarded at certain times.

- Form the female perspective, the ability to determine quality of males is reduced as the number of potential mates increases (Johnstone and Earn 1999). When there are many choices, it is time-consuming for females to assess every male. "In short, when presented with many (versus few) options, females may be more likely to confuse a lower-quality male for a higher-quality male, leading to reduced mating skew" (Lenton et al 2009 p56).

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4.2. MATING SKEW IN HUMANS

How applicable are such ideas of mating skew to humans? Lenton et al (2009) investigated the question using data from 118 speed-dating sessions in seven German cities. The sessions run by a company called FastDating involved every member of each sex meeting every member of the other sex for approximately five minutes. The number of offers (expressions of interest) made and received were calculated from the speed-daters' scorecards.

If there is a relatively even distribution of offers received by the speed-daters, this suggests no mating skew (a value near zero on statistical skew indices). While scores near one suggest that a limited number of individuals are chosen and many other ignored.

The mating skew indices showed that the average skew was significantly greater than zero. Thus speed-dating offers are not evenly distributed among all participants in the events, and some individuals are more popular than others. The skew was stronger for men (ie: female choices). The more potential mates available to choose from, the more skewed was the distribution. The speed-dating sessions varied from less than ten participants of each sex to over thirty each (with 17 as the average).

Lenton et al (2009) did not find that the mating skew was reduced as the number of potential mates increased, as with other animals. Because of the shortness of time in speed-dating, individuals are using immediate visual cues ("quick and easily assessed" (QEA) characteristics) to make decision. These are socially shared and based on media images.

Lenton et al attempted to explain the findings in terms of evolutionary theory, whereas it could be that the findings from non-human animal studies are not applicable to humans. Speed-dating is not like a lek [5], where geographically dispersed animals gather to mate (table 4.1).

- Self selecting sample of who attends sped-dating events.
- The motivations of speed-daters - eg: finding short-term or long-term partner.
- Social norms of attractiveness as presented through the media.
- Individuals make assessments based on personal criteria in speed-dating; eg: names, questions asked during "mini-dates".

Table 4.1 - Problems with comparing speed-dating with non-human animal behaviour.

[5] A lek is "an aggregated display of males, which females visit for the purpose of fertilisation only" (Höglund and Alatalo 1995).

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Other problems with Lenton et al's study include:

a) How to operationalise "mating skew"? Kokko et al (1999) compared 21 different indices (statistical techniques).

b) Mating skew indices reduce complex behaviour to a single unidimensional number (Crespi and Yanega 1995).

c) In terms of decision-making, individuals make different decisions depending upon the amount of choices. Lenton and Stewart (2008) examined the decision-making processes with a choice of 64 or 4 web-dating profiles. With the former, choices were made by eliminating cases through certain criteria (eg: black hair). This is a "non-compensatory choice strategy". With a small set of choices, individuals used "compensatory choice strategies" which weighed up the pros and cons of each potential mate (Lenton et al 2009).

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5. MALE MATE-GUARDING AND RETENTION

5.1. INTRODUCTION

The male of a species can never be 100% sure that the offspring they are caring/providing for are genetically their own, while the female can. This concern over the guarantee of paternity has led to mate-guarding and retention behaviours (or, technically, post-copulation strategies). These are behaviours used by males to stop the female from copulating with other males after him, and so be sure the offspring are genetically his.

Table 5.1 lists some examples of strategies used by males of different species (Wilson 1975), and table 5.2 shows human examples. Table 5.3 summarises the advantages and disadvantages of mate-guarding.

STRATEGY

- Mating plugs and repellents
- Prolonged copulation
- Male remains attached to female until birth of offspring
- Remove female from area where rival males are (concealment)
- Vigilance for rival males
- Physical guarding of female

Table 5.1 - Post-copulation strategies used by males.

5.2. EXAMPLES OF MATE-GUARDING IN DIFFERENT SPECIES

Some species literally guard the females and fight off rival males; eg: red deer (Cervus elaphus).

Male red deer practice polygyny with a harem. The herding of females leads to fighting between stags. The ability to defend the hinds is known as "resource holding power" (RHP)(Parker 1974). Fights can last up to twenty minutes, and 20% of them lead to some form of injury (Clutton-Brock et al 1979).

The struggle to maintain the harem leads to a loss of 20% of body weight and 80% of body fat by stags over 4-6 weeks of the rut (Clutton-Brock and Albon 1989). Furthermore, the stags rarely feed during this time, mainly because guarding the harem is a 24 hour job.

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TACTIC	EXAMPLE
- Vigilance	- Call mate unexpectedly
- Concealment of mate	- Not introduce to male friends
- Monopolise mate's time	- Spent all time with her
- Emotional manipulation	- Say "die without her"
- Derogation of competition	- Criticise her male friends
- Rejection where paternity uncertain	- Divorce on rape victims
- Commitment manipulation	- Asked her to marry him
- Verbal signals of possession	- Introduce her as his "woman"
- Physical signals of possession	- Held her hand when other men around
- Violence	- Fight other men interested in her

(After Buss 1988; 1992)

Table 5.2 - Human male tactics for retaining mate.

ADVANTAGES

1. Males guaranteed paternity, especially important if he involved in parental care with its associated risks and energy costs.

2. Males guaranteed paternity if breeding opportunities rare and/or breeding season short.

3. Males guaranteed paternity when females scarce.

4. Males with reputation for physically guarding females have better chance of mating as usually animals with "good genes" (eg: stronger, fitter).

5. Males who can guard multiple females greatly increase the number of their genes passing into future generations.

6. Once offspring born, male does not need to stay as paternity guaranteed, and can look for another female.

7. Part of male-male competition which drives aspects of evolution.

DISADVANTAGES

1. Risks involved in physical guarding; eg: fighting.

2. Energy cost of staying or holding on to female for long period including no opportunity to feed.

3. Maladaptive versions of this behaviour; eg: homicide in humans.

4. Mate-guarding has to be perfect or else waste of time; eg: too

busy fighting one rival male to notice a "sneaky" male.

5. Strategies to overcome mate-guarding by other males, varying from "sneaky" strategy to sperm displacement (remove first male's sperm from female body).

6. Strategies to overcome mate-guarding by females; eg: "clandestine copulations" (the "cuckoldry hypothesis"; Schroder 1993).

7. Risks from predators while guarding female.

Table 5.3 - Advantages and disadvantages of mate-guarding by males.

Males also roar up to three times per minute while holding harems (Clutton-Brock and Albon 1989), leading to nearly 3000 roars per day (Morell 2003).

But during a fight, the females are left unattended which could allow the opportunity for subordinate males to mate with them. Dawkins and Krebs (1978) called this the "sneaky fucker" strategy.

In frogs, mating behaviour is characterised after copulation by amplexus (the male grasps the female around the middle until the eggs are released) for several hours to weeks. Thus the male can be confident that his sperm fertilised the eggs (Purves et al 1997).

Certain female qualities will encourage the male to maintain amplexus - silence; firmness (ie: body distended with eggs); and receptiveness to the male's clasp. Females can produce release by the "release call" or vibrating her body after laying the eggs. The soft abdomen now produced is a "turn-off" for the male (Stebbins and Cohen 1995).

The clasping response is very strong during breeding, and frogs have been observed clasping to inanimate objects, like floating apples.

In some species one way in which males show their quality of genes is through a "nuptial gift" to the female. For example, the male of decorated crickets gives the female a two-part spermatophore (jelly-like substance) during copulation. The sperm contained in some "nuptial gifts", like the Mormon cricket, include substances that "turn-off" female receptivity to further males. Thus it is a sperm-protection device against male competitors (Gwynne 1990).

5.3. MATE-GUARDING BEHAVIOURS IN HUMANS

A strategy to guarantee paternity in mate guarding is seen culturally as marriage. Thus the male accepts the

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cost of loss of partners (as in polygyny) for the assurance that the offspring in the families are his.

Daly, Wilson and Weghorst (1982) noted the violent response of husbands to affairs by their wives (24% of spousal homicides by men were motivated by jealousy compared to 7.7% for women in Canada 1974-83; Daly and Wilson 1988), and the legal defence of adultery when the male murders his unfaithful wife. Men are more concerned about unfaithfulness in applying for divorce as found in Canada, and England and Wales (Buckle et al 1996).

Buss (1988) investigated the most and least frequently used tactics of mate-guarding of male students at the University of Michigan (table 5.4).

MOST FREQUENT

- I sat next to her when others were around (physical guarding)
- I put my arms around her in front of others (physical signal of possession)
- I held her hand when other guys were around (physical signal of possession)

LEAST FREQUENT

- I got her pregnant so she would stay with me (commitment manipulation)
- I got my friends to beat up the guy who was interested in her (violence)
- I hit the guy who made a pass at her (violence)

Table 5.4 - Examples of mate-guarding strategies used by male students.

As part of mate guarding, sexual jealousy in males has evolved. This would make males more attentive and vigilant of their females. Jealousy can be defined as an emotional "state that is aroused by a perceived threat to a valued relationship or position and motivates behaviour aimed at countering the threat. Jealousy is 'sexual' if the valued relationship is sexual" (Daly et al 1982 p11 quoted in Buss et al 1992 p251).

Buss et al (1992) developed a simple experiment to show the difference in types of sexual jealousy shown by males and females. In evolutionary terms, males will be jealous over paternity risk (ie: females have sex with other males), and females will be jealous over loss of the males' support during pregnancy and childcare (ie: males having emotional relationships with other females).

Students (N = 202) at the University of Michigan were asked which would distress them most using a dilemma story (figure 5.1).

Please think of a serious committed romantic relationship that you have had in the past, that you currently have, or that you would like to have. Imagine that you discover that the person with whom you've been seriously involved became interested in someone else. **What would** distress or upset you more *(please circle only one):*

(A) Imagining your partner forming a deep emotional attachment to that person.
(B) Imagining your partner enjoying passionate sexual intercourse with that other person (Buss et al 1992 p252).

Figure 5.1 - Dilemma used by Buss et al (1992).

The results showed that 60% of men reported greater distress over their partner's potential sexual infidelity compared to 17% of women. The vast majority of women (83%) reported greater distress over emotional infidelity (vs 40% of men).

When the study was replicated with 309 more undergraduates, having experienced a committed sexual relationship produced more sexual jealousy among men (55%) compared to 29% of men having not had such a relationship.

The levels of physiological arousal to the scenario were also measured using another fifty-five undergraduates. Skin conductance, pulse rate, and muscle activity in the furrowing of the brow were measured. Males showed greater arousal on all three measures for sexual infidelity than women, and females showed greater arousal in skin conductance and muscle activity in brows for emotional infidelity than men.

Gangestad et al (2002) found that mate-guarding behaviours increased around the time of the women's peak fertility (just before ovulation) for men in the early stages of relationships with thirty-one non-contraceptive pill-using women.

Mate-guarding behaviour also varies depending on the attractiveness of the men (less attractive greater mate-guarding just before ovulation), and the women (less attractive same, but more attractive greater mate-guarding all the time)(Haselton and Gangestad 2006).

Mate-guarding strategies have been studied in humans in different situations; eg: students in the USA (Buss 1988), Caribbean village (Flinn 1988).

A particular human manifestation of mate-guarding is the "culture of honour" (Nisbett and Cohen 1996). A key element of such a culture is that the male is prepared to protect with violence his assets/mate and his reputation for strength and toughness to protect said assets. So "to maintain credible power of deterrence, the individual

must project a stance of willingness to commit mayhem and to risk wounds or death for himself" (Nisbett and Cohen 1996 pxv). Thus the concern about affronts that could be construed as a challenge to the reputation to hold the assets.

A "culture of honour", like the southern USA, will show patterns of behaviour different to non-cultures (eg: northern USA):

i) Homicide rates after apparently trivial arguments (eg: insults about reputation) will be higher (Nisbett 1993);

ii) Positive attitudes towards violence that protects reputation.

Cohen et al (1996) (appendix 5A) devised an experiment using men from southern and northern USA who were insulted and physically pushed in the presence or absence of witnesses. Men from the southern USA who were insulted were more likely to believe that their reputation for strength and toughness was damaged in the eyes of the observers. They also showed a rise in cortisol levels (evidence of stress) and testosterone levels, and were more aggressive in subsequent parts of the experiment (eg: completing a story about a husband finding his wife kissing another man).

Other attitudes also cluster together in the "culture of honour"; eg: opposition to gun control, and support for capital punishment (Cohen 1996).

iii) Female support for men's behaviour as shown by the socialising of sons (but not daughters) to respond to insults (Nisbett and Cohen 1996).

Shackelford (2005) highlighted three questions about the "culture of honour":

a) What is the nature of the psychology underlying a "culture of honour"?

b) How is the "culture of honour" maintained?

Nisbett and Cohen (1996) argued that, in the southern USA, it was cattle herding in an environment of weak formal authorities that produced the "culture of honour" behaviour. Herds can easily be stolen, and a weak law enforcement, meant that men had to fight for themselves to protect their assets. Cattle herding, however, is a minority activity in the southern USA today.

c) Why don't public insults elicit more violence than private insults?

Cohen et al (1996) found that insulted men reacted

the same whether in the presence of observers or not.

Shackelford (2005) attempted to answer his questions by explaining the behaviour in the "culture of honour" as due to "evolved reputation maintenance mechanisms". These evolved mechanisms are there for all men, but there is a requirement of environmental factors that allow or limit violent behaviour (eg: strength of law enforcement agencies).

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APPENDIX 5A: Cohen et al (1996)

A confederate bumps into the participant as he walks down the hallway and calls him an "asshole". White male undergraduate students at the University of Michigan were used, and they were divided into "southerners" based on lived in any of sixteen southern US states (eg: North Carolina, Florida, Texas) for at least six years.

Cohen et al's first experiment measured the reaction of the participants to the insult using 42 northern and 41 southern students. The scenario was this:

As the participant walked down the hall, a confederate of the experimenter walked out of a door marked "Photo Lab" and began working at a file cabinet in the hall. The confederate had to push the file drawer in to allow the participant to pass by him and drop his paper off at the table. As the participant returned seconds later and walked back down the hall toward the experimental room, the confederate (who had reopened the file drawer) slammed it shut on seeing the participant approach and bumped into the participant with his shoulder, calling the participant an "asshole." The confederate then walked back into the "Photo Lab." Two observers were stationed in the hall. They appeared to be working on homework, paying no attention to the goings-on in the hall. One (male) observer was seated on the floor in a location where he could glance up and see the participant's face at the moment he was bumped (p948).

The control group did not have this incident.

The reaction to this incident was measured by:

- Word completion task - eg: the participant is given "gu_" and can complete it as "gun", "gut", or "gum".

The first choice is taken as hostility;

- Face rating task involving guessing the emotion being expressed in a photograph;

- Scenario completion task - a man is rescued by an ambulance, or a challenge:

It had only been about twenty minutes since they had arrived at the party when Jill pulled Steve aside, obviously bothered about something.
"What's wrong?" asked Steve.
"It's Larry. I mean, he knows that you and I are engaged, but he's already made two passes at me tonight."
Jill walked back into the crowd, and Steve decided to keep his eye on Larry. Sure enough, within five minutes Larry was reaching over and trying to kiss Jill (p948).

Importantly, the participants were debriefed and reconciled with the confederate after the experiment.

Trained observers rated more southerners as angry (85%) than northerners (35%) after the bump. In terms of the tasks, only the challenge scenario produced a significant difference between southerners and northerners. The difference being in ending the story with violence (table 5A.1).

	INSULT	CONTROL
SOUTHERNERS	75	20
NORTHERNERS	41	55

Table 5A.1 - Percentage of participants ending the challenge scenario using violence or threat of violence.

In experiment 2, Cohen et al measured the cortisol and testosterone levels of the participants after the insult incident. Cortisol is a measure of stress and arousal, and testosterone is associated with aggression. The participants were also given the opportunity to show their toughness by agreeing to receive a 25-volt electric shock in an "electric shock stress test". This experiment used 173 white male undergraduates, with sixty-two classed as southerners. The insult incident was similar to experiment 1, but was varied in front of an audience (public) or not (private).

Cortisol levels rose by 70% for insulted southerners, and testosterone levels by 12% compared to baseline measures based on saliva samples (table 5A.2).

	CORTISOL		TESTOSTERONE	
	CONTROL	INSULT	CONTROL	INSULT
SOUTHERNERS	42	79	4	12
NORTHERNERS	39	33	4	6

Table 5A.2- Percentage changes from baseline measures.

The southerners volunteered to receive more electric shocks than northerners in front of an audience when insulted or not.

Experiment 3 measured three other aspects of behaviour related to a "culture of honour":

- Participants were asked what an observer of the insult incident would think of the participant;
- Another confederate blocked the hallway to see if the participant would force himself pass:

> After the participant was bumped or not bumped, he continued walking down the long hallway. Another confederate—who was 6 ft 3 in. (1.91 m) and 250 lbs (114 kg)—appeared around the corner and began walking toward the participant at a good pace. The hall was lined with tables, so there was room for only one person to pass without the other person giving way. The new confederate walked down the centre of the hall on a collision course with the participant and did not move (except at the last second to avoid another bumping). In essence, we set up a "chicken" game.. (p953).

- The participant's handshake was rated for firmness on a seven-point scale.

148 white male undergraduates (60 southerners) took part in this experiment using the same basic procedure as experiment 1. The insulted southern participants were more aggressive towards the confederate blocking the hallway, were rated as having firmer handshakes, and believed an observer saw them as less tough after the insult incident in public (table 5A.3).

The three experiments by Cohen et al (1996) found significant differences between students at the University of Michigan from southern and northern USA. The southern students showed behaviours that fit with the "culture of honour":

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	SOUTHERNERS		NORTHERNERS	
	CONTROL	INSULT	CONTROL	INSULT
Distance at which gave way to confederate (inches)	108	37	75	60
Firmness of handshake (1-7; 7 = firmest)	3.9	4.5	4.15	4.05
Participant's guess about observer's rating of his masculinity (1-5; 5 = more masculine)	3.5	3.15	3.5	3.35

Table 5A.3 - Summary of results from experiment 3.

- Greater anger at insult (experiment 1);
- More aroused by insult (experiment 2);
- Need to show toughness after insult incident (experiments 2 and 3);
- Belief that others saw them as less tough after insult incident (experiment 3).

Key Evaluations of Methodology

1. Classification of southern states varied between experiments; eg: students from suburbs of Washington DC included as southern in experiments 2 and 3.

2. Complex scenarios with confederates are difficult to control and standardise, as well as ethical issues about the deception involved.

3. Samples limited size and only those recruited by telephone at University of Michigan. Of the total number of participants (n = 404), only 163 (40%) were classed as southerners.

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